Geophysical Research Abstracts
Vol. 19, EGU2017-16423-4, 2017
EGU General Assembly 2017

Power Plant Emission Monitoring in Munich Using Differential Column Measurements

Jia Chen (1), Hai Nguyen (1), Francisco Toja-Silva (1), Ludwig Heinle (1), Frank Hase (2), André Butz (3,4)

(1) Environmental Sensing and Modeling, Technical University of Munich, Munich, Germany, (2) Institute of Meteorology and Climate Research, Karlsruhe Institute of Technology, Karlsruhe, Germany, (3) Institute of Atmospheric Physics, German Aerospace Center, Weßling, Germany, (4) Meteorological Institute, Ludwig-Maximilians-Universität, Munich, Germany

Differential column measurements using compact Fourier transform spectrometers (EM27/SUN) have shown to be an effective method to determine the greenhouse gas emissions. Citywide measurement campaigns were carried out in Boston, Indianapolis, San Francisco, etc., focusing on city (e.g. emissions from natural gas infrastructure) and local sources. We are particularly working on validating this novel method for attributing and quantifying local emission sources. Optimal strategies are developed for measuring in different seasons with various sun elevations.

We have deployed two spectrometers to monitor the CO_2 and CH_4 emission rates (kg s^{-1}) of a natural gas fired combined heat-and-power plant in Munich, Germany (Heizkraftwerk Süd). We placed our spectrometers in the vicinity (<800 m) of the power plant and measured the differences between the column-averaged dry-air mole fractions at a downwind and a non-downwind site of the power plant ($\Delta X_{\mathrm{CO_2}}$ and $\Delta X_{\mathrm{CH_4}}$). Measurements in summer and winter have been carried out.

We compared the measured data of $\Delta X_{\mathrm{CO_2}}$ with the results of a Gaussian plume model and a computational fluid dynamics simulation using OpenFOAM. The determined emission rates agree well with our a priori knowledge of the inflow.

In this work, we discuss the accuracy of the differential column measurements for determining power plant emissions and explore their sensitivities to meteorological and model parameters. In addition, we present measurement strategies and experimental design criteria for different meteorological conditions and time of the year, including winter when the sun elevation is low and the column inclination becomes very important. Differential column measurements using compact spectrometers are shown to be a reliable method to monitor power plant emissions.